

through the mass of loosely-packed shreds of beet root. The loose cellular structure of the root is rapidly permeated by the hot water, and the denser saccharine juice in the beet cells passes rapidly through the walls of the cells, being replaced by the water. When the water which entered the bottom reaches the top of the vessel it passes down by means of a pipe and enters the lower end of the adjoining diffusor, where it passes through another mass of cut beets, and so on until the water has become sufficiently charged with sugar, when it is transferred to the vessel where the saccharine fluid is decolourised and purified. By this process the cosettes which are continually exposed to the action of fresh portions of water are rapidly exhausted, and so completely is the sugar taken from them that when emptied they seldom contain more than from two to three-tenths of 1 per cent of this substance.

The next process is the purification of the sap, which leaves the diffusor as a dark sugary liquid with a rather disagreeable odour and taste, and passes into the carbonation tank. When the latter is about half full of sap, lime freshly slacked and mixed with water is passed into it, steam being turned on to raise the temperature of the fluid. The proportion of lime used in this first treatment is usually equal to about 2 per cent of dry lime. The temperature of the juice is gradually raised by the steam introduced until it reaches 190 to 200 Fahr., which coagulates the albuminous matter. The caustic lime forms a soluble compound with a portion of the sugar known as sucrate of lime, which is decomposed by passing carbonic acid gas into the fluid forming an insoluble carbonate of lime, which on settling carries down with it a large portion of the colouring substances. After treatment the milky mixture of sap and carbonate of lime is pumped into the filter presses, where all the sedimentary matter is separated and the transparent liquid flows out of a light yellow colour.

In most factories the saccharine fluid after filtration undergoes a second treatment with lime added in much smaller proportion, followed by carbonic acid gas and another filtration, after which the last trace of colour is removed by treatment with sulphurous acid gas. In other factories filtering the sap through bone black takes the place of the second treatment with lime and the after treatment with sulphurous acid. This also decolourizes the solution effectually. The clarified liquid is next concentrated by boiling in large cylindrical evaporators, in a partial vacuum, by which the boiling point is much lowered, the vacuum being created by the action of powerful air pumps, while the steam escaping from the first evaporator is used to raise the temperature in the next.

When sufficiently concentrated the fluid is transferred to another vacuum pan, where it is boiled until it is so far thickened that it granulates on cooling. When this point is reached the sugar is dropped from the bottom of the vacuum pan into another vessel below, where it forms a dark-coloured pasty mass, consisting of sugar crystals enveloped in about one-fourth their weight of molasses, and when cooled it is transferred in successive portions to the centrifugal machines, which, when set in motion, make about 1,200 revolutions a minute. The rapid motion to which the sugar is subjected has the effect of throwing the mass evenly against the sides of the centrifugal and also of throwing off the molasses, which, passing through the wire backing with which the centrifugal machines are furnished, escapes through a tube below into a suitable receptacle, the sugar in the course of 10 or 15 minutes becoming either a light-coloured raw sugar or a white refined sugar, depending to some extent on the method of treatment as well as on the perfection of the apparatus.

If refined directly from the first crystallization the last trace of colour is removed by using a jet of steam associated with compressed air on the revolving sugar in the centrifugal, by means of which the last portions of the adhering molasses are removed from the crystals, leaving them pure and white. The refined white sugar, still damp, is elevated to an upper chamber, where it enters a long cylindrical iron vessel fixed on an inclined plane which revolves around a coil of steam pipes within. By the revolutions of the cylinder the sugar is frequently thrown on the warmed surface of the pipes, and in this way by the time it reaches the lower end it is thoroughly dried. It is then passed through sieves by means of which a uniform grade of finely granulated white sugar is produced.